

What is claimed is:

1. A method for producing a nanostructured composite material comprising,

a) providing a polymer derived ceramic (PDC) precursor;

b) providing a block copolymer having a block that is molecularly compatible with said

5 PDC precursor;

c) mixing said block copolymer and said PDC precursor;

d) polymerizing said PDC precursor to form said nanostructured composite material; and

e) calcining said nanostructured composite material to form a nanostructured non-oxide ceramic material.

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2. The method of claim 1, whereby said block copolymer is a block copolymer including an apolar block and a polar block.

3. The method of claim 2, whereby said apolar block is selected from the group

15 comprising polyisoprene, polybutadiene, polydimethylsiloxane, methylphenylsiloxane, polyacrylates of C<sub>1</sub>-C<sub>4</sub> alcohols, polymethacrylates of C<sub>3</sub>-C<sub>4</sub> alcohols, hydrogenated polyisoprene, and hydrogenated polybutadiene.

4. The method of claim 2, whereby said polar block is selected from the group

20 comprising polyethylene oxide, polyvinyl alcohols, polyvinylamines, polyvinylpyridines, polyacrylic acid, polymethacrylic acid, hydrophilic polyacrylates and amides, hydrophilic polymethacrylates and amides, and polystyrenesulfonic acids.

5. The method of claim 1, whereby said block copolymer is poly(isoprene-block-ethylene oxide).

6. The method of claim 2, whereby said PDC precursor is a silazane.

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7. The method of claim 6, whereby said silazane is a ureamethylvinylsilazane.

8. The method of claim 1, whereby said PDC precursor is a silazane.

10 9. The method of claim 8, whereby said silazane is a ureamethylvinylsilazane.

10. The method of claim 1, whereby said block copolymer exhibits a morphology known from the phase behavior of block copolymers.

15 11. The method of claim 1, whereby said block copolymer is provided in a solution comprising said block copolymer and tetrahydrofuran.

12. The method of claim 1, whereby said PDC precursor is added in varying amounts with respect to said block copolymer.

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13. The method of claim 1, whereby said step of polymerizing occurs using a radical initiation.

14. The method of claim 13, whereby said radical initiation includes providing a radical initiator.

15. The method of claim 14, whereby said radical initiator is dicumyl peroxide.

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16. The method of claim 15, whereby said radical initiation further includes heating to a temperature of 120 °C.

17. The method of claim 1, whereby said step of polymerizing includes subjecting said  
10 PDC precursor to thermal energy or UV light energy.

18. The method of claim 1, whereby said PDC precursor is a non-oxide ceramic precursor.

15 19. The method of claim 18, whereby said block copolymer is poly(isoprene-block-ethylene oxide).

20. The method of claim 18, whereby said PDC precursor is a silazane.

20 21. The method of claim 20, whereby said silazane is a ureamethylvinylsilazane.

22. The method of claim 18, whereby said nanostructured non-oxide ceramic material.  
is a high temperature SiCN or SiC material.